



WELCOME TO THE LIVING LABORATORY



Established as part of the 2014 Boulder Transportation Master Plan, the “Living Laboratory” program introduces new transportation designs that take a Complete Streets approach in an effort to increase comfort and safety of all roadway users and guide enhancements to create a connected network of low-stress routes for people walking and biking. It offers pilot projects for people to experience and provide feedback on how these treatments address their needs for improved mobility, comfort and safety. Each Living Lab pilot project is installed for a duration of 12 to 18 months to allow experimentation and evaluation.

How does it affect me?

Once installed, community members are encouraged to use pilot project corridors and share their experience. In particular how does the new design treatment change your feelings of comfort, safety and confidence while completing your trip whether walking, biking, riding the bus or driving.

Why Now?

Living Lab pilot projects support the 2014 TMP implementation plan and Boulder’s commitment to providing all community members safe access for all travel choices. With an average trip length of about four miles, many of the trips made by Boulder residents could be accomplished by bike or bus. But, it is likely that almost two-thirds of our community doesn’t feel comfortable or confident sharing the roadway with motor vehicles as a bicyclist. Additionally, most of our arterial roadways lack the pedestrian and transit amenities to encourage walking.

National Campaign for safety

We are not alone in this goal. The City of Boulder has joined over 200 cities in the U.S. Department of Transportation’s **Mayor’s Challenge** and **Safer People, Safer Streets** initiative to increase walking and biking, to reduce pedestrian and bicyclist fatalities by addressing non-motorized safety issues, and to help communities create safer, better connected bicycling and walking networks.

Living Lab projects directly link to this initiative by evaluating safety and comfort. The Boulder TMP also calls for a focus on Vision Zero – eliminating accidents and fatalities on roadways through conscious design and road treatments. One of the best ways to make this happen is through Complete Streets design.

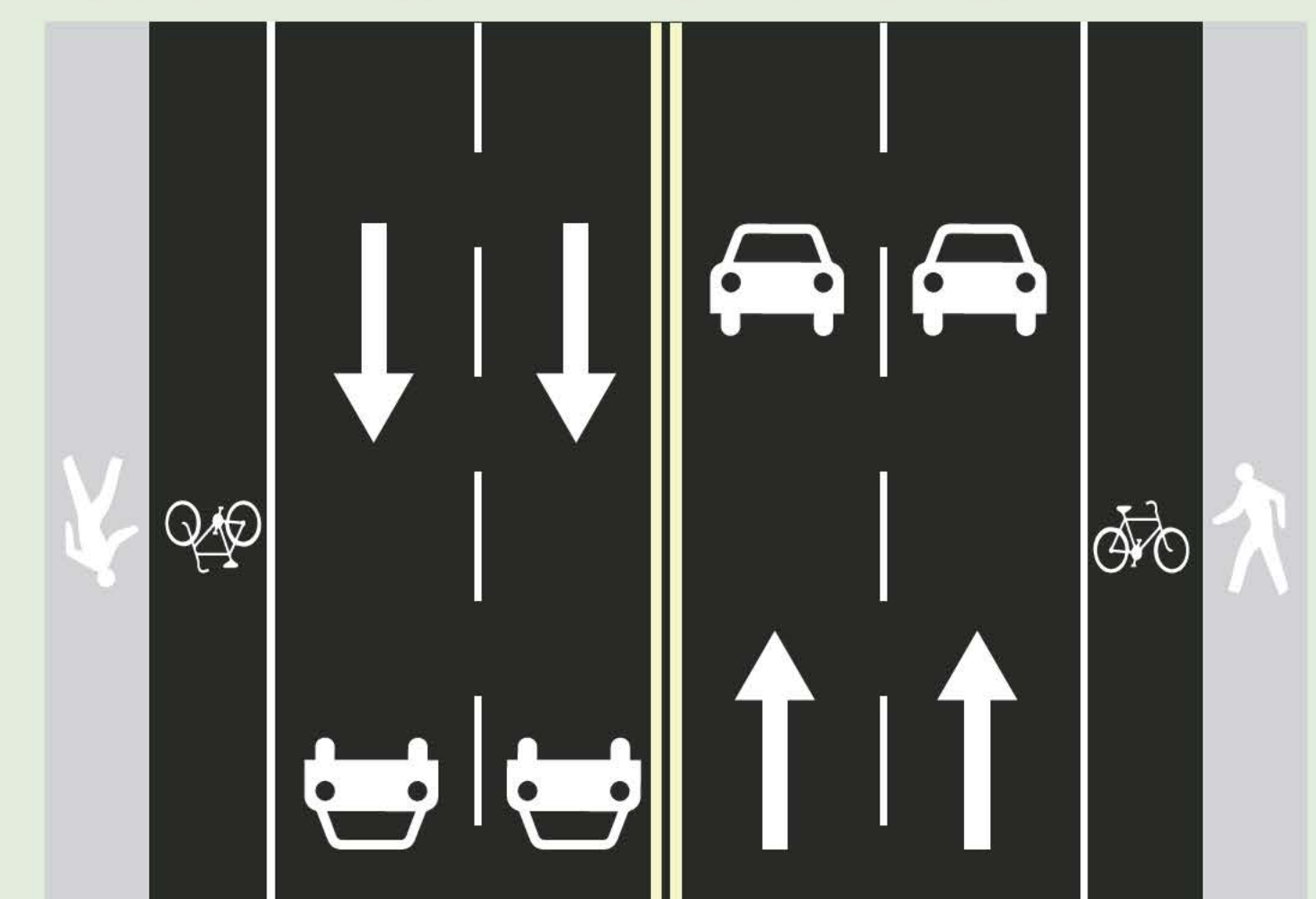
Complete Street Corridors

“**Complete Streets** are streets for everyone. They are designed and operated to enable safe access for all users, including pedestrians, bicyclists, motorists and transit riders of all ages and abilities. **Complete Streets** make it easy to cross the street, walk to shops, and bicycle to work. They allow buses to run on time and...enable safe access for all users, regardless of age, ability, or mode of transportation. This means that transportation projects will make the street network better and safer for drivers, transit users, pedestrians, and bicyclists.”

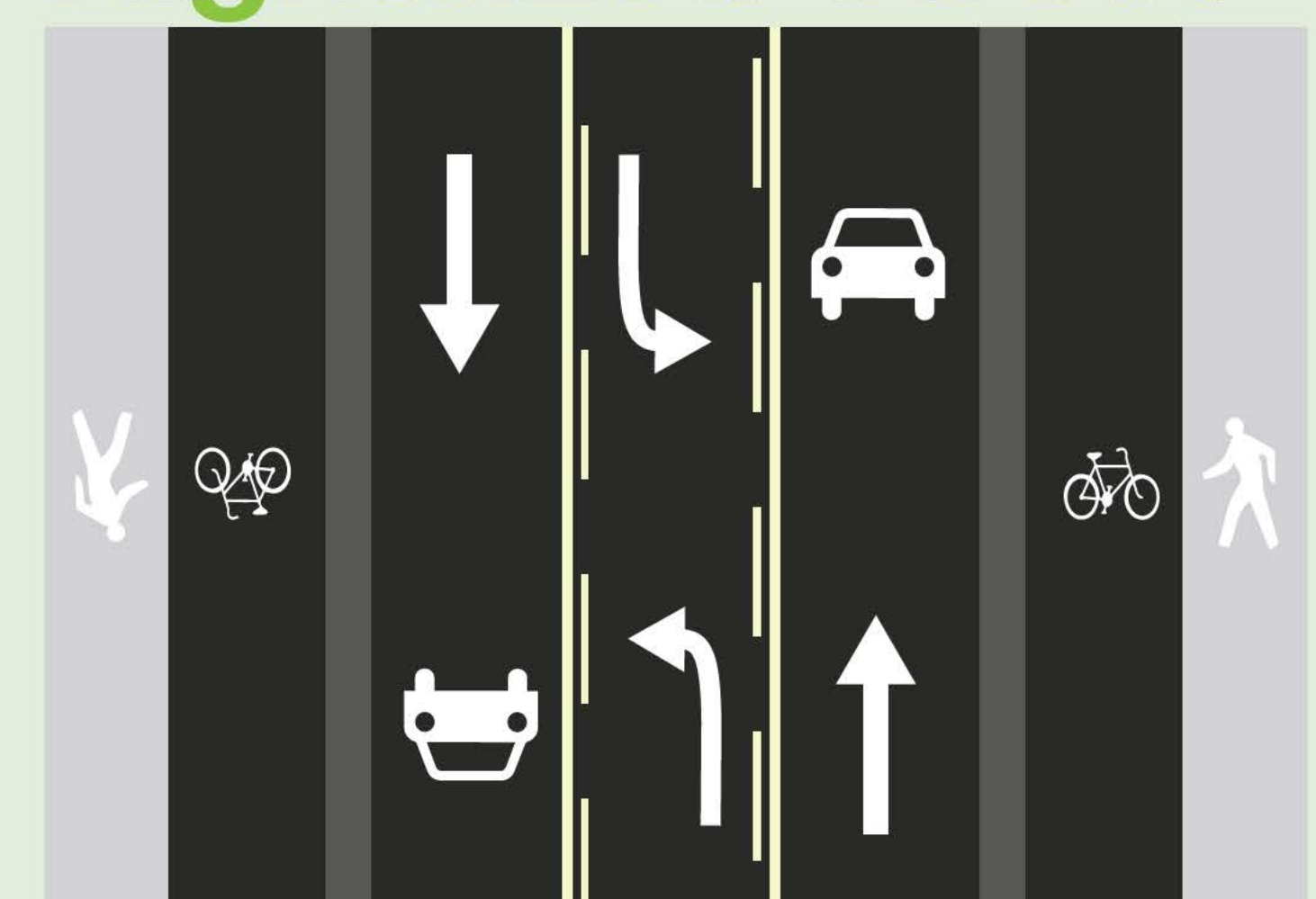
— Smart Growth America

In support of Complete Streets, the City is considering rightsizing pilot projects that would repurpose travel lanes along certain multiuse arterial roadways to enhance access and safety for all modes of travel. Candidate corridors include segments of Iris Avenue and 55th, 63rd and Folsom streets.

Current Street

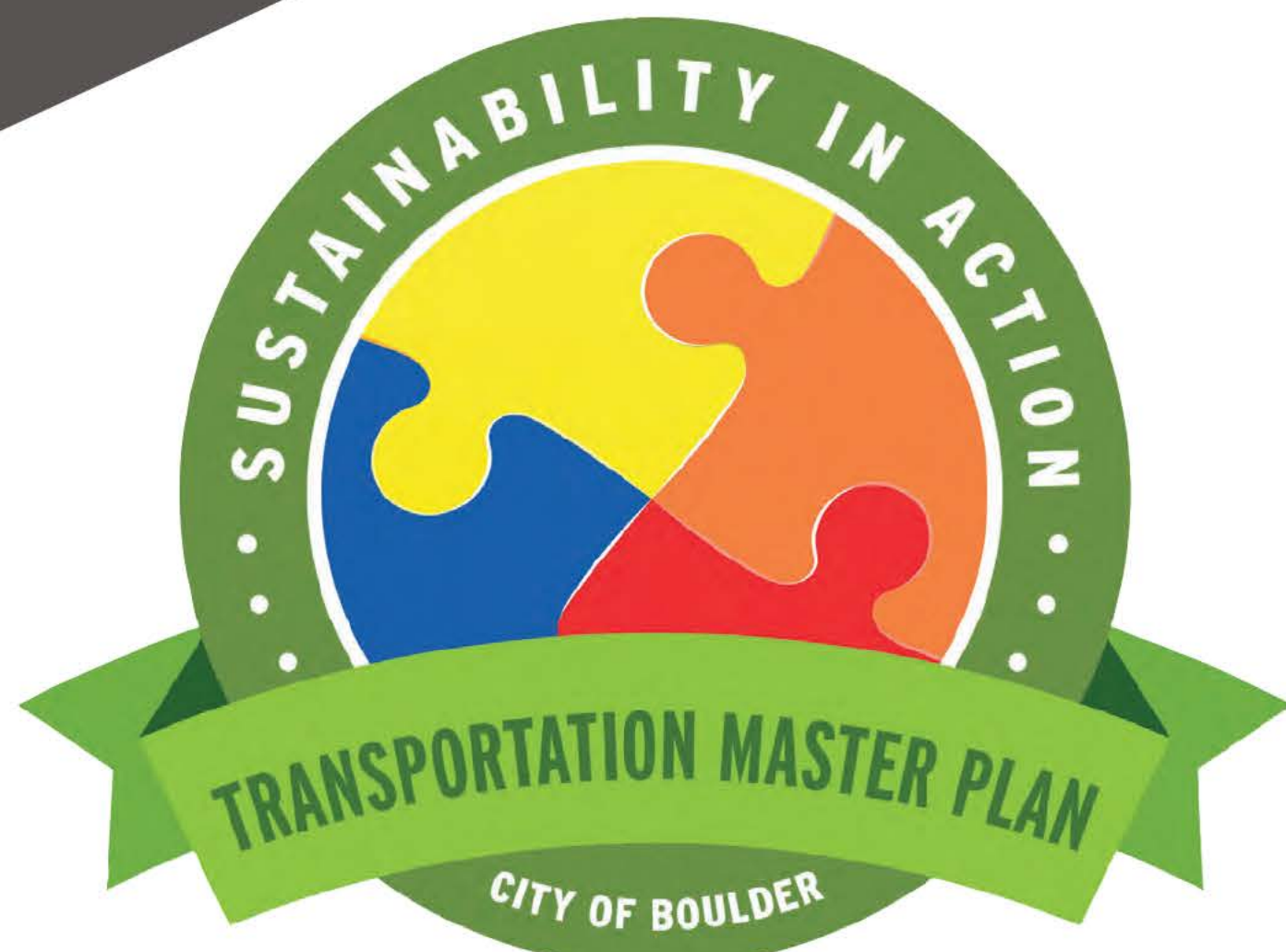


Rightsized Street





2014 TRANSPORTATION MASTER PLAN AND THE LINK TO LIVING LAB



A vision of the 2014 Transportation Master Plan (TMP) is to create and maintain a safe and efficient multimodal transportation system meeting the sustainability goals of the community and increased options for walking, biking, and transit.

Boulder's Transportation Master Plan's (TMP) objectives include safety improvements for people using all modes of transportation working "Toward Vision Zero" for fatal and serious injury crashes. Complete Streets also supports the National Campaign, Safer People, Safer Streets. Cities across the country are committing to improve the safety and comfort of our streets for people of all ages and stage of life.



Currently, Boulder residents:

RIDE THE BUS

2x

THE NATIONAL AVERAGE



WALK

3x

THE NATIONAL AVERAGE



BICYCLE

21x

THE NATIONAL AVERAGE



The TMP sets ambitious yet realistic mode share goals of:

30%

BIKE

25%

WALK

10%

TRANSIT MODE SHARE

for all trips taken within the city

To accomplish these goals, the TMP's Complete Streets focus area supports innovative approaches to enhance walking, biking and transit opportunities for people who live, work, and visit Boulder, with an emphasis to increase walk and bike trips by women, older adults and families.

According to the 2012 Boulder Travel Diary Survey

- Men bike at a rate 2x that of women
- Women make more Single Occupant Vehicle Trips than men
- Currently there are more bike trips for recreation than transportation

Many trips made by Boulder residents could be accomplished by bus or bike.

4 MILES:
AVERAGE BOULDER TRIP

2/3 OF COMMUNITY
less confident & comfortable
biking or walking

2014 TMP OBJECTIVES

Reduce Vehicle Miles Traveled (VMT) by 20%

Reduce SOV to 20% of Trips

Reduce Mobile Source Emissions

Max of 20% Roadways at LOS F

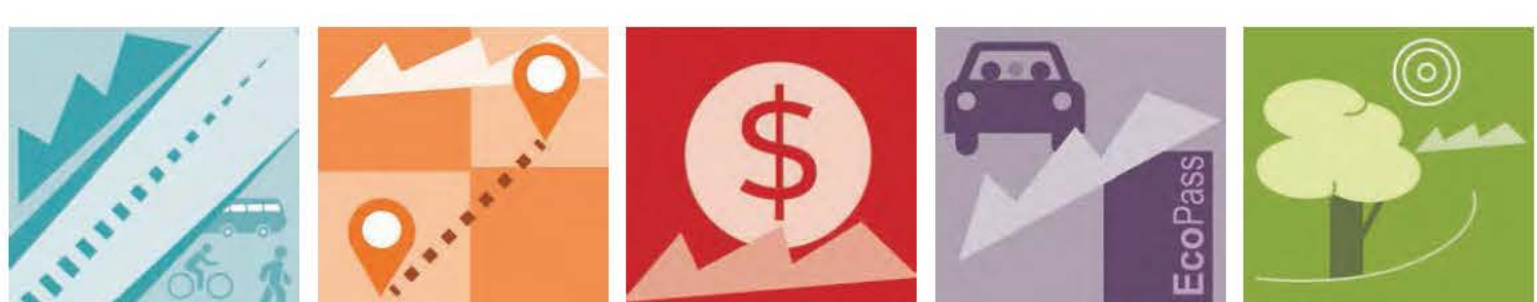
Expand Fiscally Viable Alternatives for Residents & Employees

Increase Alternatives with rate of Employee Growth

Safety Vision Zero

Increase Neighborhood Accessibility 15 min neighborhoods

Reduce VMT per Capita by 20% Residents & Employees



More info: www.bouldercolorado.gov/goboulder





LIVING LAB PROJECT STATUS PHASE I AND II

Living Lab Project Status

The Living Lab program is being deployed in phases of pilot projects, with qualitative and quantitative analysis, including extensive community feedback, to evaluate the potential for long-term application in Boulder. Phase I projects have been opportunistic and have provided an excellent forum for testing contemporary treatments to improve Boulder's existing bicycle system.



Back in angle parking, University Avenue



Barrier protected bike lanes, Baseline Road



Buffered bike lanes, Spruce Street

Phase I wave 2 installed Nov. 2014



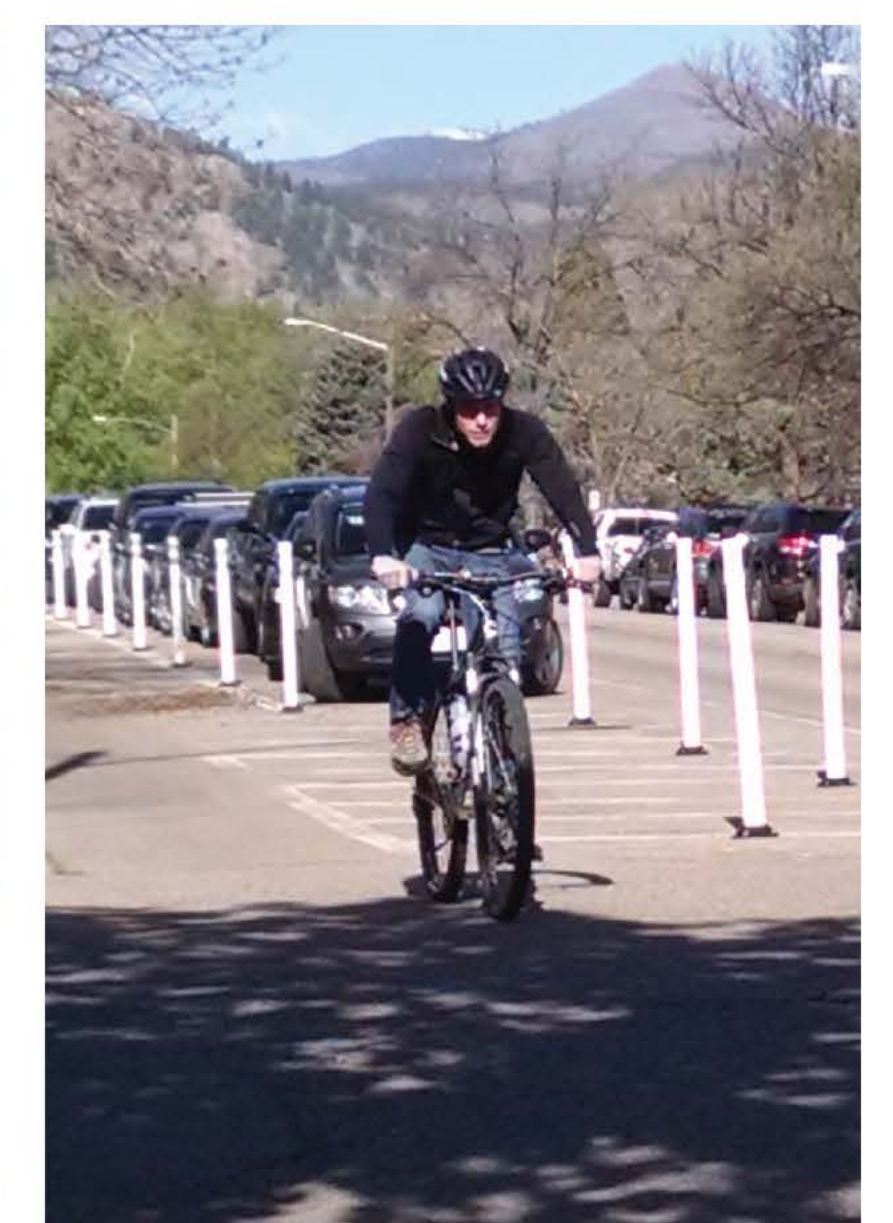
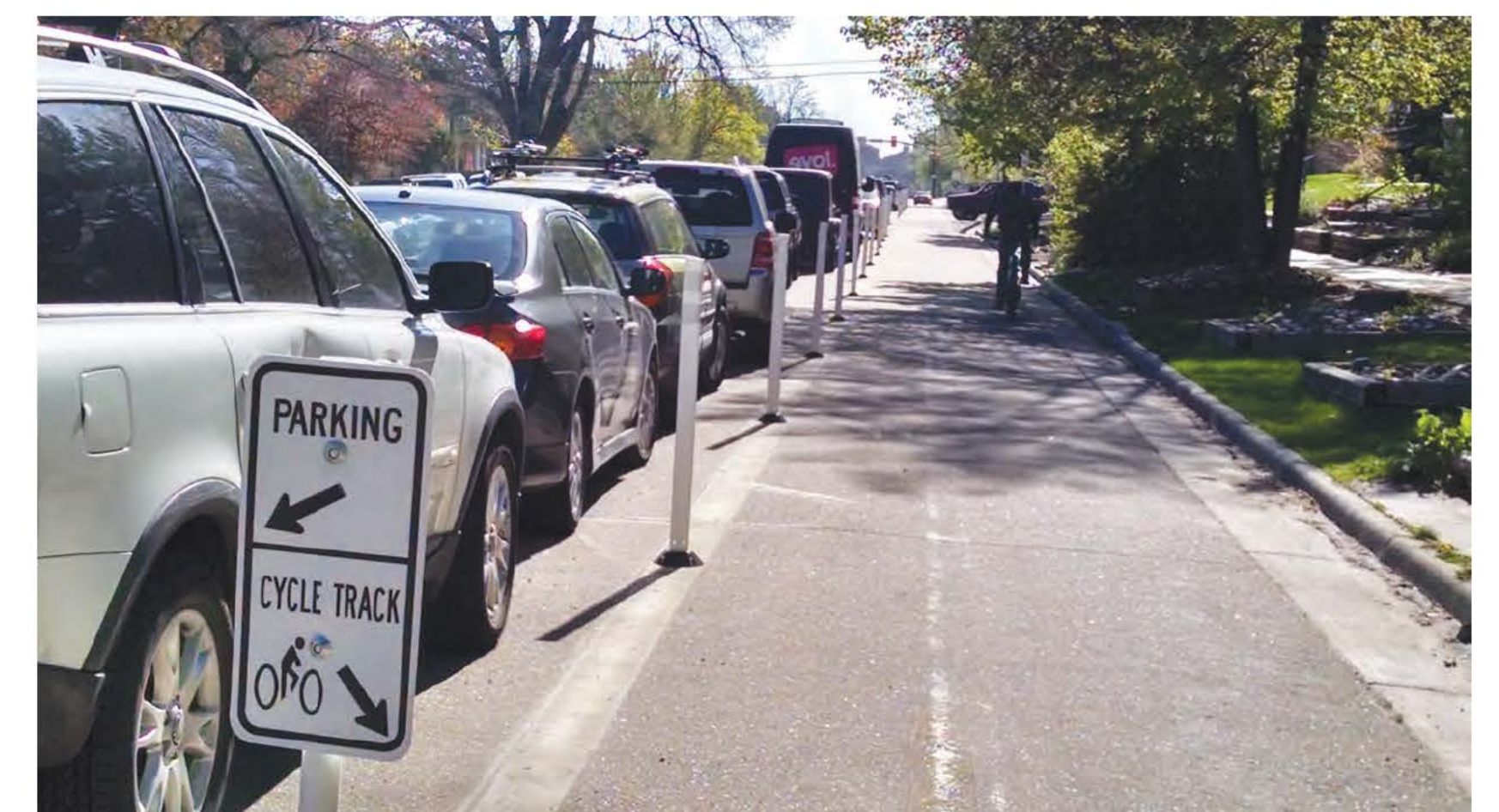
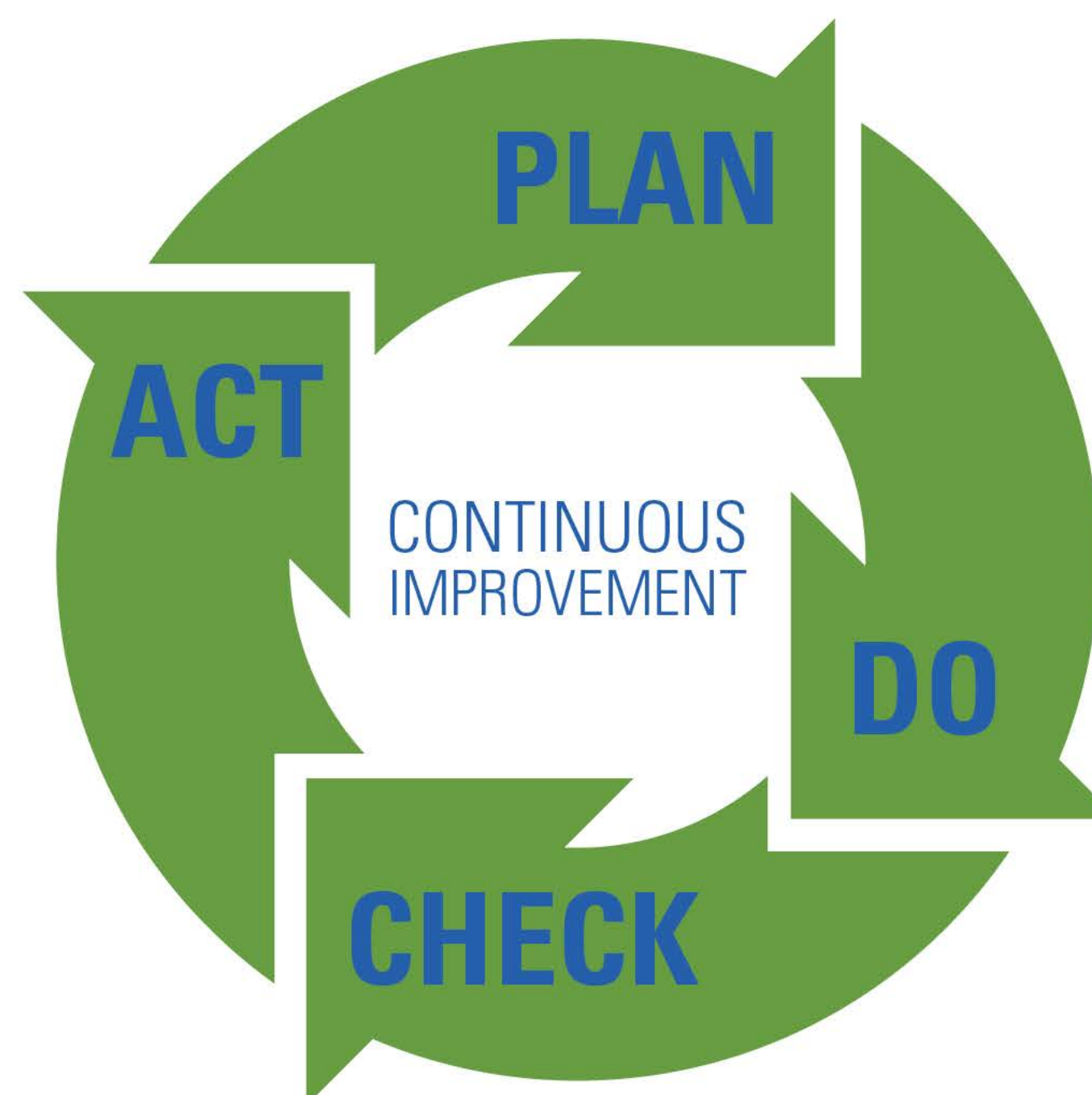
Parking protected bike lanes, University Avenue



Dashed bike lanes, Harvard Lane

Some Lessons learned

- Increase winter maintenance along the University Avenue cycle track.
- Installed flexible bollards to better delineate separate bike and parking lanes during snowy conditions.



Phase II Corridor Rightsizing pilot projects

Selection Criteria

An initial analysis of multimodal transportation operational criteria was used to identify the corridors, including:

- Bicycle level of stress
- Bicycle and motor vehicle volume
- Travel time
- Speed (posted and actual)
- Land use
- Connectivity to primary activity centers

The corridors that matched these criteria are the Phase II Living Lab projects:

- ▶ **55th Street**
Baseline Road to Pearl Parkway
- ▶ **63rd Street**
Gunbarrel Avenue/Nautilus Drive to Lookout Road

- ▶ **Folsom Street**
Arapahoe to Valmont Avenues
- ▶ **Iris Avenue**
Broadway to Folsom Street

More info: www.bouldercolorado.gov/goboulder





14 WAYS TO MAKE BIKE LANES BETTER

A GUIDE TO THE WAYS TO PROTECT A BIKE LANE



STRIPED BUFFER

1.5 ft. additional width; \$8k-\$16k per lane-mile

PROTECTION LEVEL	+	+	+	+	+
INSTALLATION COST	\$	\$	\$	\$	\$
DURABILITY	⬮	⬮	⬮	⬮	⬮
AESTHETICS	👁	👁	👁	👁	👁



DELINEATOR POSTS

1.5 ft. additional width; \$15k-\$30k per lane-mile

PROTECTION LEVEL	+	+	+	+	+
INSTALLATION COST	\$	\$	\$	\$	\$
DURABILITY	⬮	⬮	⬮	⬮	⬮
AESTHETICS	👁	👁	👁	👁	👁



TURTLE BUMPS

1.5 ft. additional width; \$15k-\$30k per lane-mile

PROTECTION LEVEL	+	+	+	+	+
INSTALLATION COST	\$	\$	\$	\$	\$
DURABILITY	⬮	⬮	⬮	⬮	⬮
AESTHETICS	👁	👁	👁	👁	👁



LARGE BUMPS

1.5 ft. additional width; \$15k-\$30k per lane-mile

PROTECTION LEVEL	+	+	+	+	+
INSTALLATION COST	\$	\$	\$	\$	\$
DURABILITY	⬮	⬮	⬮	⬮	⬮
AESTHETICS	👁	👁	👁	👁	👁



OBLONG LOW BUMPS

1.5 ft. additional width; \$10k-\$20k per lane-mile

PROTECTION LEVEL	+	+	+	+	+
INSTALLATION COST	\$	\$	\$	\$	\$
DURABILITY	⬮	⬮	⬮	⬮	⬮
AESTHETICS	👁	👁	👁	👁	👁



PARKING STOPS

6 in. additional width; \$20k-\$40k per lane-mile

PROTECTION LEVEL	+	+	+	+	+
INSTALLATION COST	\$	\$	\$	\$	\$
DURABILITY	⬮	⬮	⬮	⬮	⬮
AESTHETICS	👁	👁	👁	👁	👁



LINEAR BARRIERS

6 in. additional width; \$25k-\$75k per lane-mile

PROTECTION LEVEL	+	+	+	+	+
INSTALLATION COST	\$	\$	\$	\$	\$
DURABILITY	⬮	⬮	⬮	⬮	⬮
AESTHETICS	👁	👁	👁	👁	👁



PARKED CARS

11 ft. for parking + buffer; \$8k-\$16k per lane-mile

PROTECTION LEVEL	+	+	+	+	+
INSTALLATION COST	\$	\$	\$	\$	\$
DURABILITY	⬮	⬮	⬮	⬮	⬮
AESTHETICS	👁	👁	👁	👁	👁



JERSEY BARRIERS

2 ft. additional width; \$80k-\$160k per lane-mile

PROTECTION LEVEL	+	+	+	+	+
INSTALLATION COST	\$	\$	\$	\$	\$
DURABILITY	⬮	⬮	⬮	⬮	⬮
AESTHETICS	👁	👁	👁	👁	👁



PLANTERS

3 ft. additional width; \$80k-\$400k per lane-mile

PROTECTION LEVEL	+	+	+	+	+
INSTALLATION COST	\$	\$	\$	\$	\$
DURABILITY	⬮	⬮	⬮	⬮	⬮
AESTHETICS	👁	👁	👁	👁	👁



RIGID BOLLARDS

2 ft. additional width; \$100k-\$200k per lane-mile

PROTECTION LEVEL	+	+	+	+	+
INSTALLATION COST	\$	\$	\$	\$	\$
DURABILITY	⬮	⬮	⬮	⬮	⬮
AESTHETICS	👁	👁	👁	👁	👁



CAST IN PLACE CURB

12 in. additional width; \$25k-\$80k per lane-mile

PROTECTION LEVEL	+	+	+	+	+
INSTALLATION COST	\$	\$	\$	\$	\$
DURABILITY	⬮	⬮	⬮	⬮	⬮
AESTHETICS	👁	👁	👁	👁	👁



12" PRECAST CURB

1.5 ft. additional width; \$400k-\$600k per lane-mile

PROTECTION LEVEL	+	+	+	+	+
INSTALLATION COST	\$	\$	\$	\$	\$
DURABILITY	⬮	⬮	⬮	⬮	⬮
AESTHETICS	👁	👁	👁	👁	👁



RAISED BIKEWAY

No additional width; \$8m-\$26m per lane-mile

PROTECTION LEVEL	+	+	+	+	+
INSTALLATION COST	\$	\$	\$	\$	\$
DURABILITY	⬮	⬮	⬮	⬮	⬮
AESTHETICS	👁	👁	👁	👁	👁

The ratings for aesthetics are subjective, based on full life-cycles. For details on all ratings, visit bit.ly/14bikelanes.

GREEN LANE PROJECT

peopleforbikes



Developed from research by Nathan Wilkes,
City of Austin.



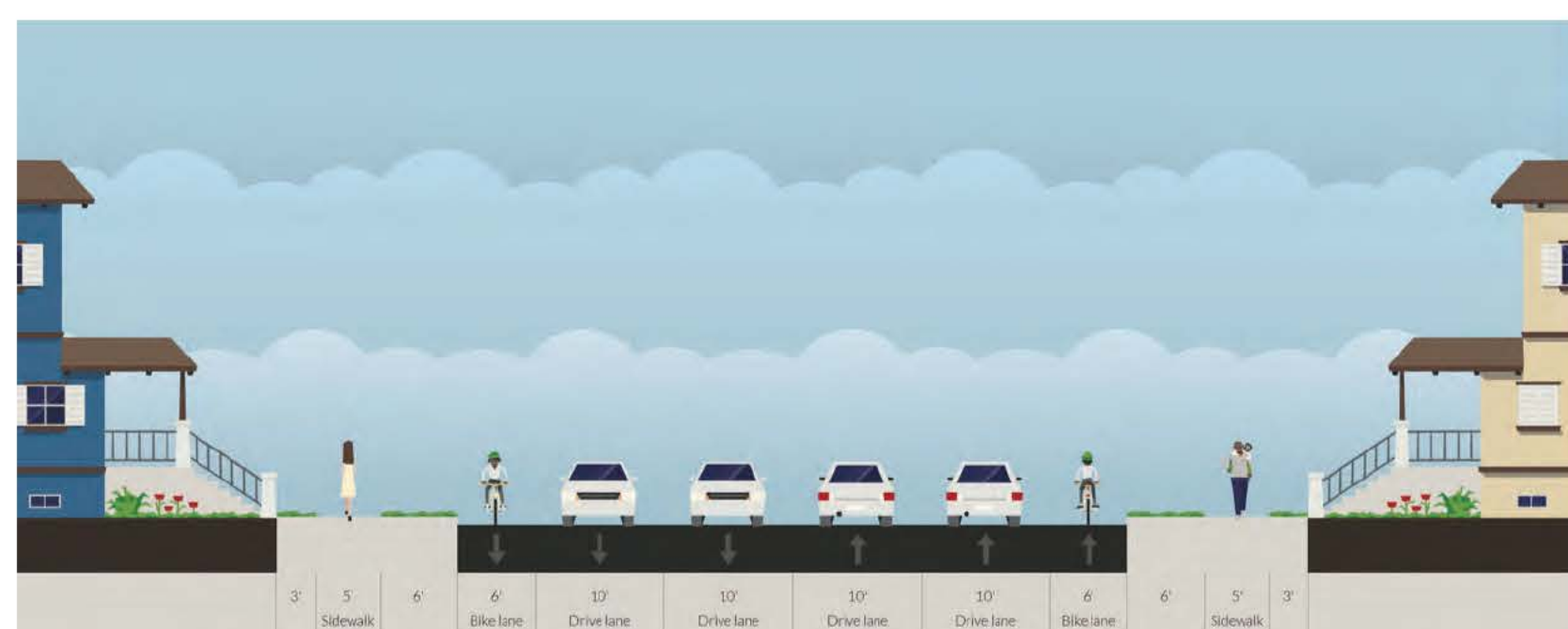
More info: www.bouldercolorado.gov/goboulder



RIGHTSIZE OPTIONS

Existing Conditions

All four candidate corridors consist of four vehicle travel lanes — two lanes in each direction with additional pocket left turn lanes at specific intersections.



Street Configuration 1:

- Provides the widest buffer between motor vehicle traffic and bicycle/pedestrian traffic.
- Effective design only if vehicle left turning traffic is low and there are plenty of gaps in on-coming traffic to allow left turns.



Street Configuration 2:

- Provides buffer between motor vehicle traffic and bicycle/pedestrian traffic.
- Provides space for left turn lanes at key, signalized intersections.
- Continuous left turn lane allows turning vehicles to move out of through lane; therefore reducing the potential for rear-end motor vehicle collisions.
- Effective on roadways with higher through and left turning volumes.



Where was 4 to 2 Lane Conversion Considered?

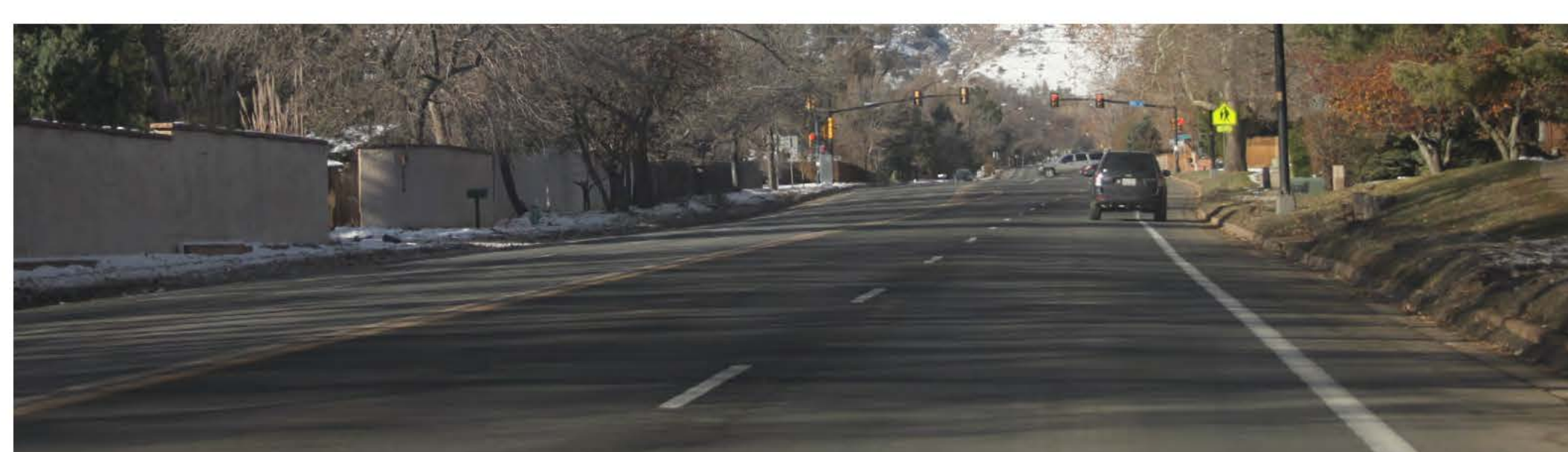
- The entire Iris corridor and Folsom north of Pine Street.
- Folsom south of Pine, 55th, and 63rd Street all have medians present that prohibit restriping the 4 to 2 lane conversion.



◀ Folsom south of Pine



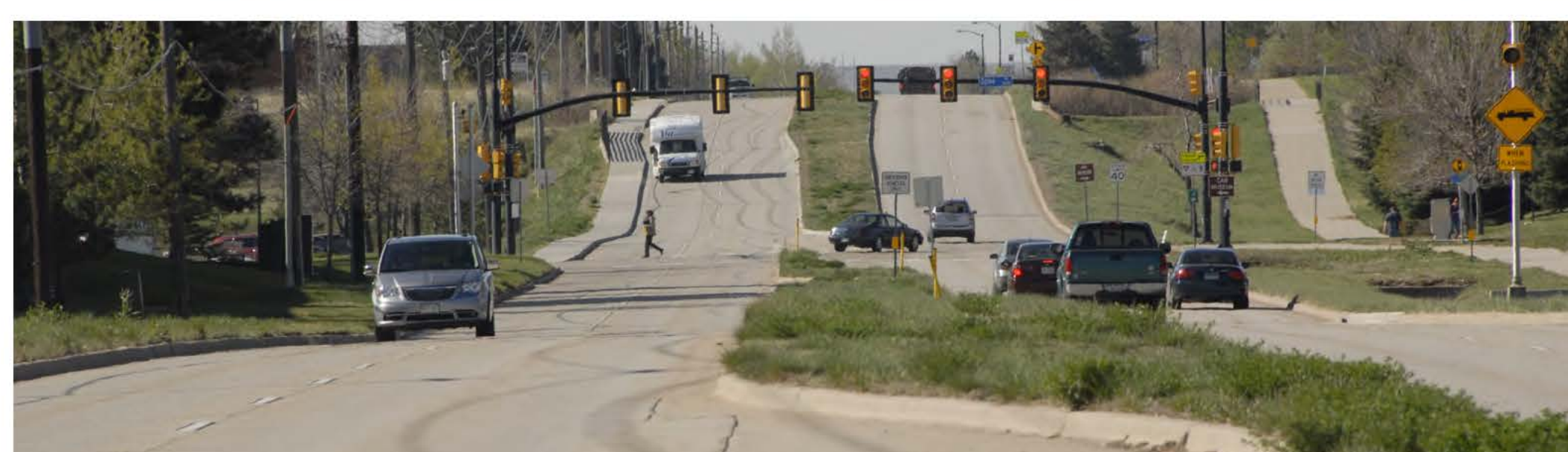
◀ Folsom north of Pine



◀ Iris



◀ 55th



◀ 63rd

Preliminary Analysis of the 4 to 2 Lane Conversion for Iris & Folsom Identified the Following Safety Considerations:

- Left turn volumes (turning onto side streets) at key intersections are too high.
- National Cooperative Highway Research Program (NCHRP) research has shown that left turn lanes are warranted on a 2-lane roadway with the volume that the corridors currently carry.
- A motor vehicle stopped in the through lane waiting to turn left creates the potential for rear-end collision.
- Motor vehicles may try to drive around a turning vehicle and thereby enter into the buffer/bike lane.
- The Folsom corridor has significant horizontal & vertical curvature, which can limit sight distance.
- Considering horizontal and vertical sight distance when deciding on a 4 to 3 or 4 to 2 conversion is consistent with FHWA guidance.

Moving forward, all righting option designs considered for the corridors are based on Street Configuration 2.

More info: www.bouldercolorado.gov/goboulder



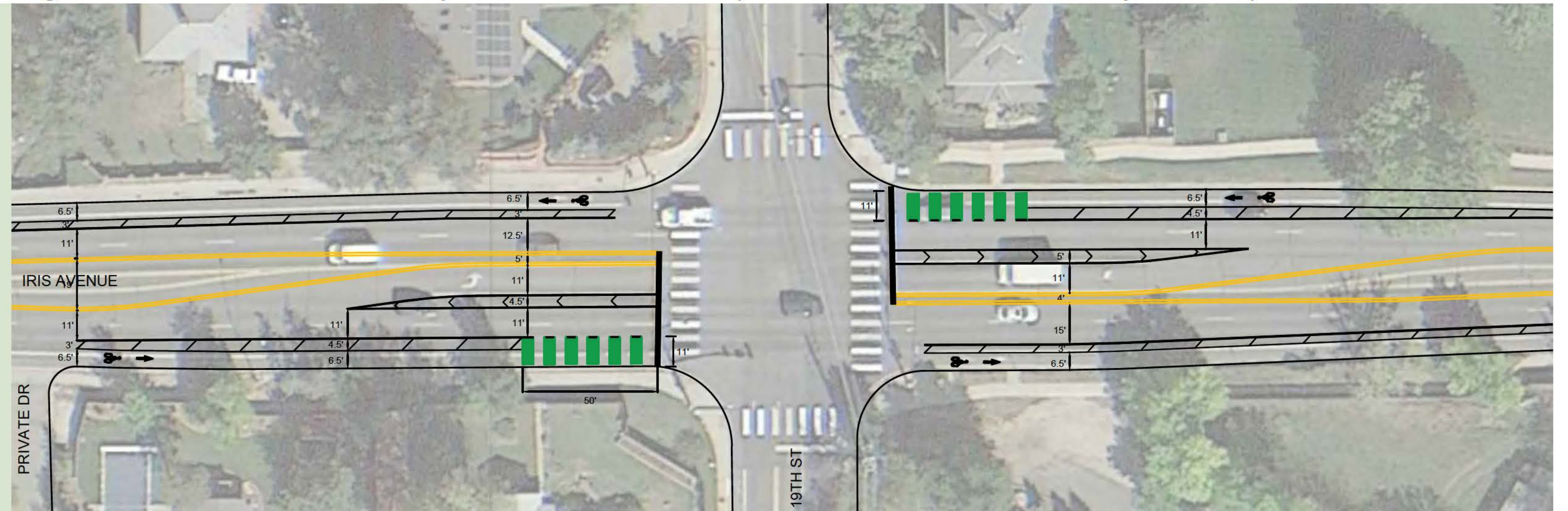


INTERSECTION TREATMENTS

Design treatments will be tested to evaluate the interactions of bicyclists, pedestrians, and vehicles at intersections. Designs differ based on volume of vehicles turning right.

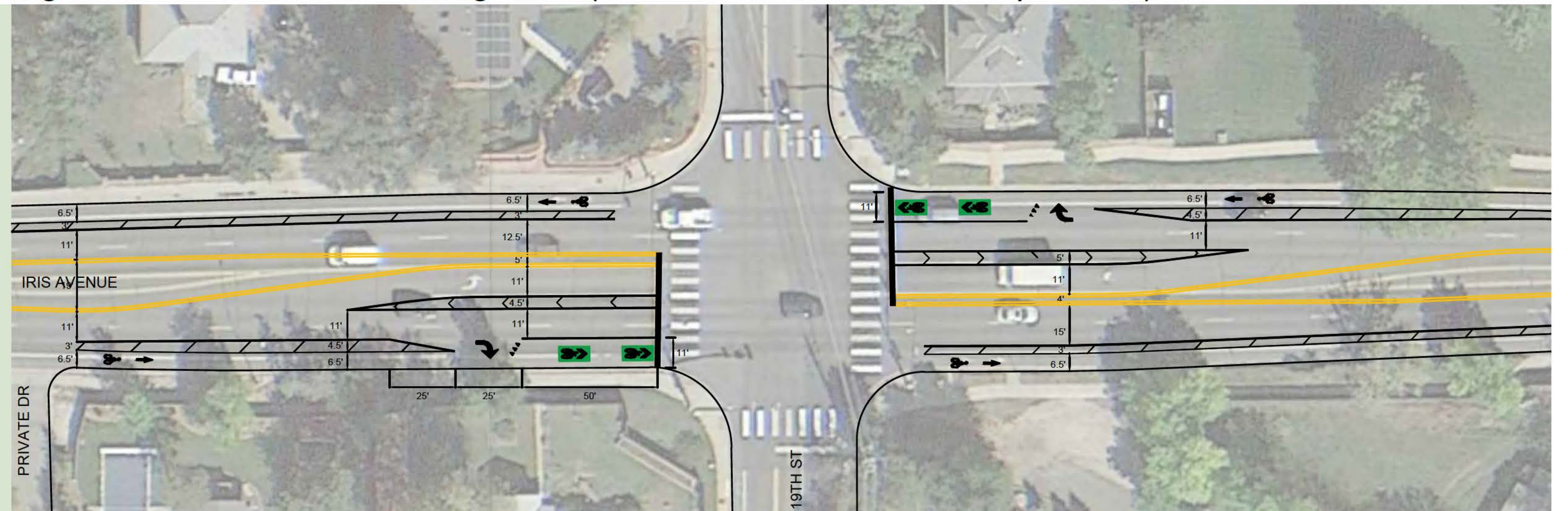
Right-Turn Treatment 1 - Skip with Green Dash (Threshold: 1-75 vehicles per hour)

LOW
volume of vehicles
turning right



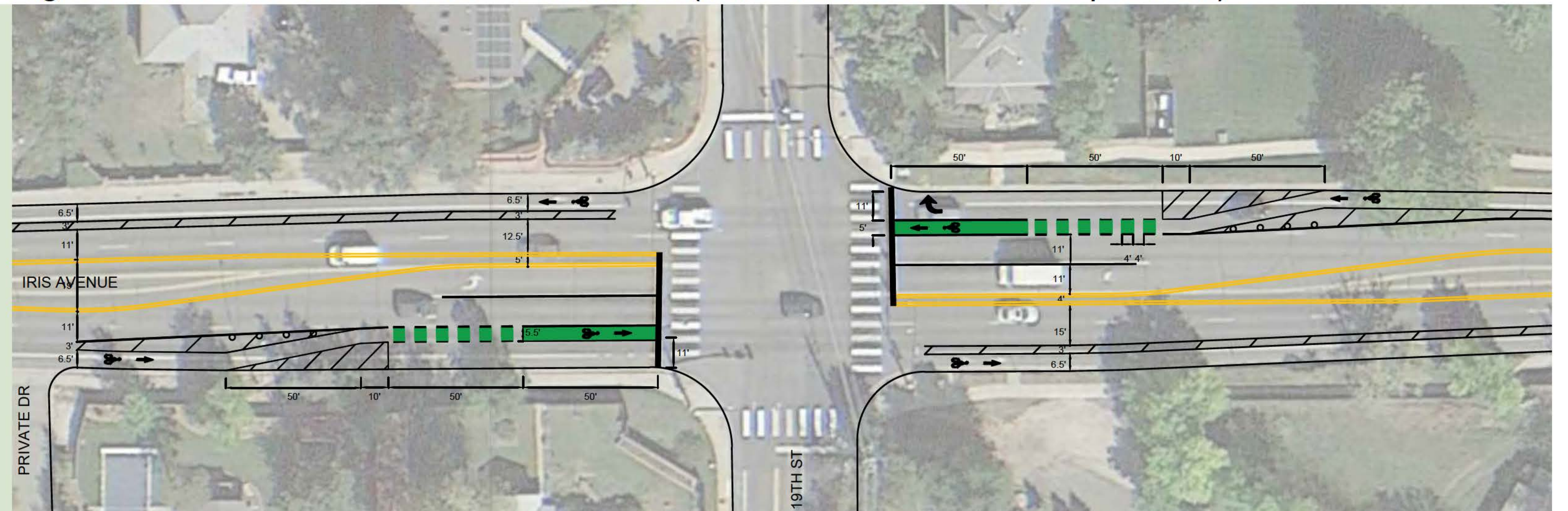
Right-Turn Treatment 2 - Mixing Zone (Threshold: 76-125 vehicles per hour)

MEDIUM
volume of vehicles
turning right



Right-Turn Treatment 3 - Buffered Transition (Threshold: 126+ vehicles per hour)

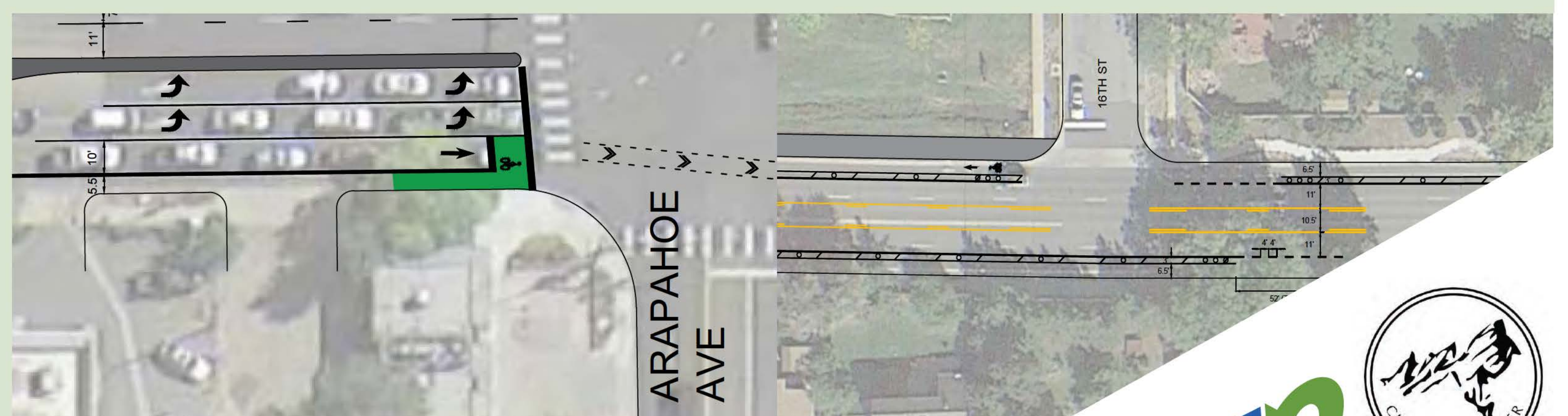
HIGH
volume of vehicles
turning right



**Other Intersection
Treatments**

Bike Box

Unsignalized Intersection



More info: www.bouldercolorado.gov/goboulder



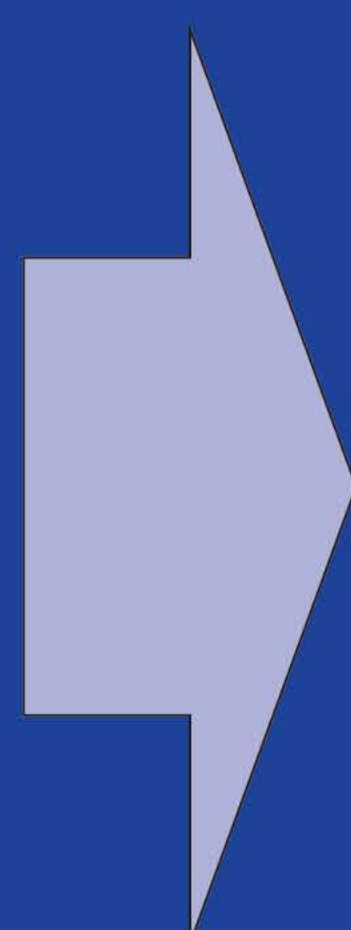


SELECTION AND EVALUATION CRITERIA

Phase II - Selection Criteria

“Rightsizing” multi-lane arterial roadways

- Local street vs. state highway
- Cross section/number of lanes
- Vehicle Speed
- Collision history
- Multimodal LOS
- Multimodal Traffic volumes
- Resurfacing schedule
- Displaced traffic



- Iris Avenue
- Folsom Street
- 55th Street
- 63rd Street

Phase II Technical Analysis

- Collected travel times
- Utilized traffic models
 - Synchro
 - VISSIM
- Purpose:
 - Existing vs. proposed
 - Potential fatal flaws
 - Corridor impacts
 - LOS and queuing
 - Anticipated travel times



Post Installation Evaluation



Multi-modal Technical Data

- ▶ Speed
- ▶ Travel time
- ▶ Volume
- ▶ Crash History

Observation Data

- ▶ Demographics
- ▶ Behavior conflicts

Community Input

- ▶ Inquire Boulder
- ▶ Bike/Walk Audits
- ▶ Pop-up events
- ▶ Surveys
- ▶ Stakeholder meetings

More info: www.bouldercolorado.gov/goboulder





N. FOLSOM ST.

RIGHTSIZING CONDITIONS



EXISTING CONDITIONS



Folsom between Valmont and Bluff



Folsom south of Valmont



Folsom and Pearl
looking NW

More info: www.bouldercolorado.gov/goboulder





S. FOLSOM ST.

RIGHTSIZING CONDITIONS



EXISTING CONDITIONS



Folsom and Canyon looking north



Not much room for bicyclists



Bicyclists queued at intersection

More info: www.bouldercolorado.gov/goboulder

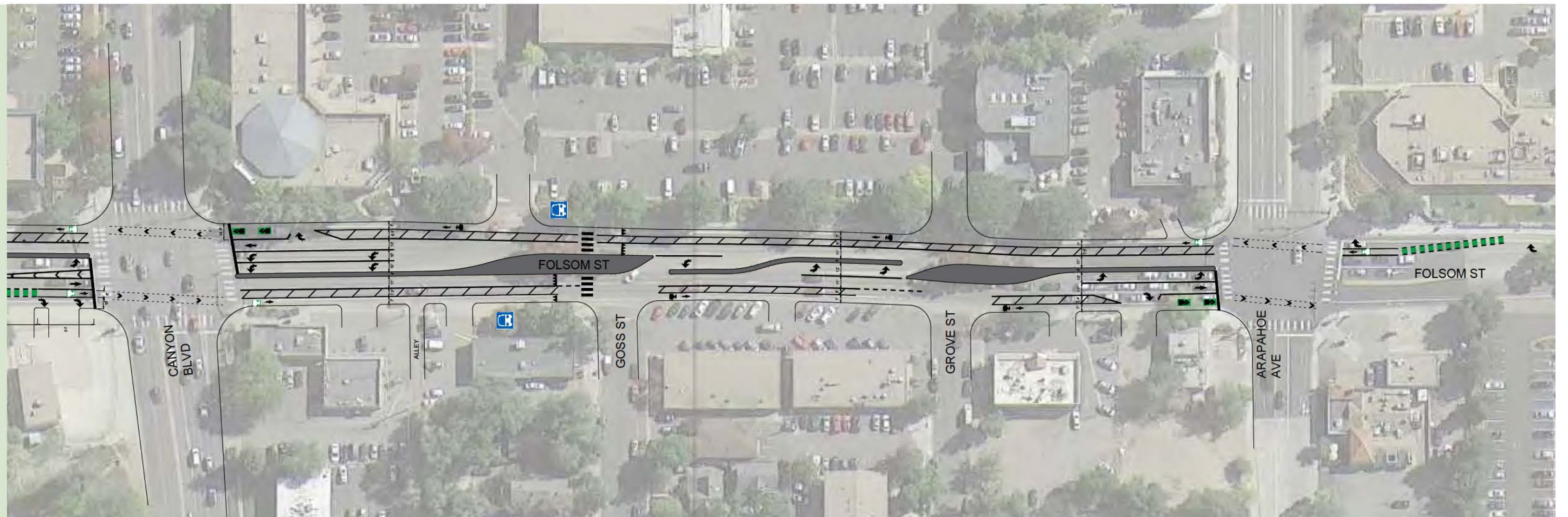




FOLSOM ST. OPTIONS

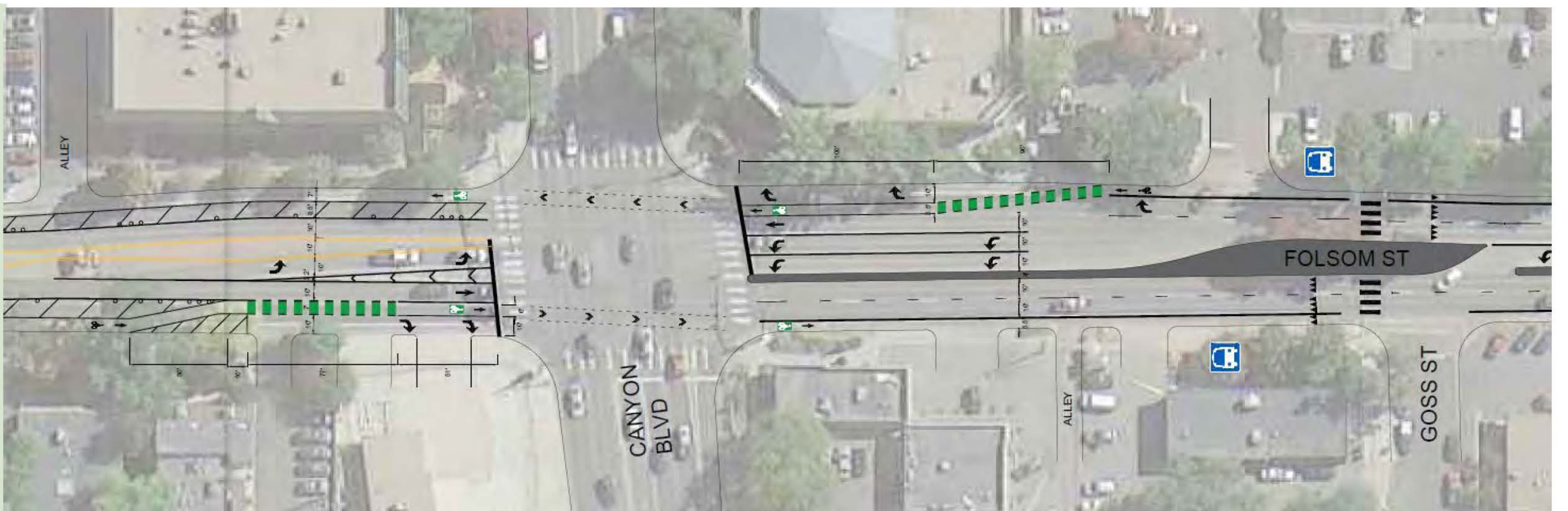
Folsom 1

Valmont Road to
Arapahoe Road



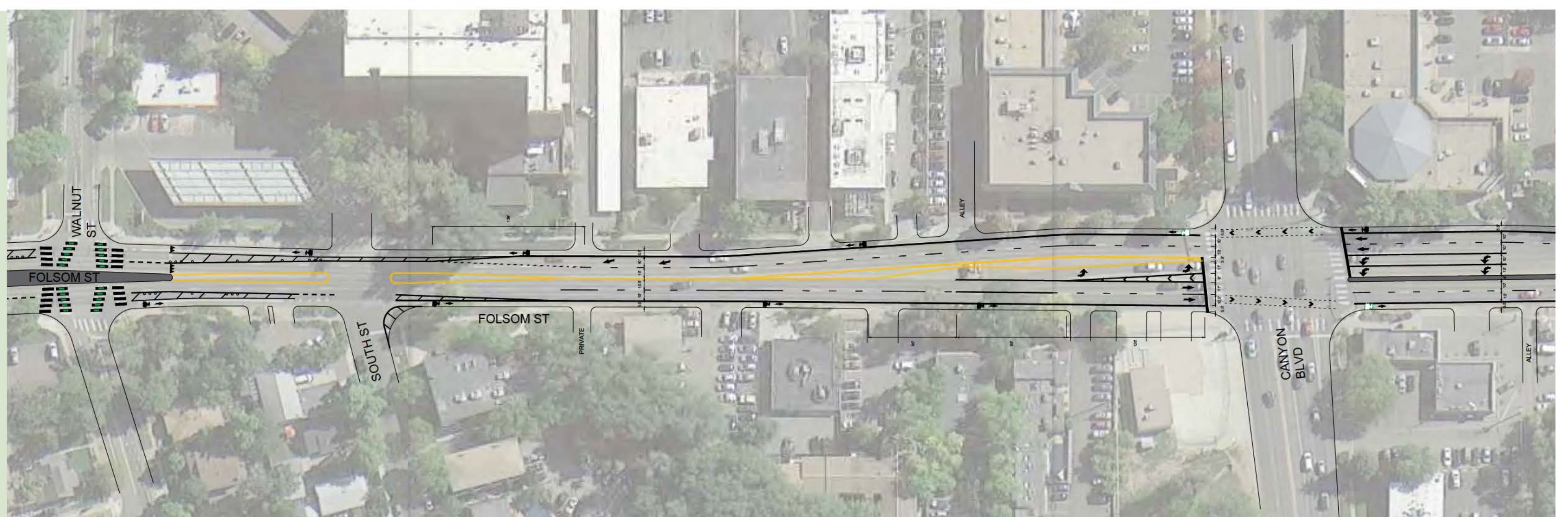
Folsom 2

Valmont Road to
Canyon Blvd



Folsom 3

Valmont Road to
South Street



More info: www.bouldercolorado.gov/goboulder





FOLSOM ST. OPTIONS

Existing Conditions	<ul style="list-style-type: none"> • Four/five lane arterial roadway with substandard vehicle and bike lanes in each direction. 	
Proposed Conditions	<ul style="list-style-type: none"> • Two lane arterial roadway with continuous center two-way left turn lane or left turn bays and protected bike lanes in each direction along specific segments of the corridor. • Design options below provide multiple rightsizing extensions along corridor for consideration. 	

Options	Considerations	What option do YOU like best?
Folsom 1 Valmont Road to Arapahoe Road	<ul style="list-style-type: none"> • Provides buffered bikeway the entire length of the corridor in both directions. • Increases delay and queue of SB traffic between Canyon Blvd and Arapahoe Ave. The queues extends a large portion of corridor. • Increases average SB travel time significantly (nearly double) in the PM peak hour. • Increases NB travel time by one minute 17 seconds in the PM peak hour. 	
Folsom 2 Valmont Road to Canyon Blvd	<ul style="list-style-type: none"> • Maintains vehicular capacity SB at Arapahoe for high-volume left-turn. • Reduces SB queues from impacting entire corridor when compared to option F-1. • Mitigates potential increases of the VISSIM-modeled average travel time to less than 78 seconds in each direction and during both peak hours. • Provides a SB bike box at Arapahoe Ave. 	
Folsom 3 Valmont Road to South Street	<p>Same as F-2 except:</p> <ul style="list-style-type: none"> • Improves vehicular operations at Arapahoe Ave and Canyon Blvd. • Results in less travel time increase compared to other F-1 or F-2 options • Moves the beginning of the NB buffered bikeway to South St. • Ends the SB buffered bikeway at South St. • Introduces a lane reduction with merge for NB vehicles. 	

More info: www.bouldercolorado.gov/goboulder





IRIS AVENUE

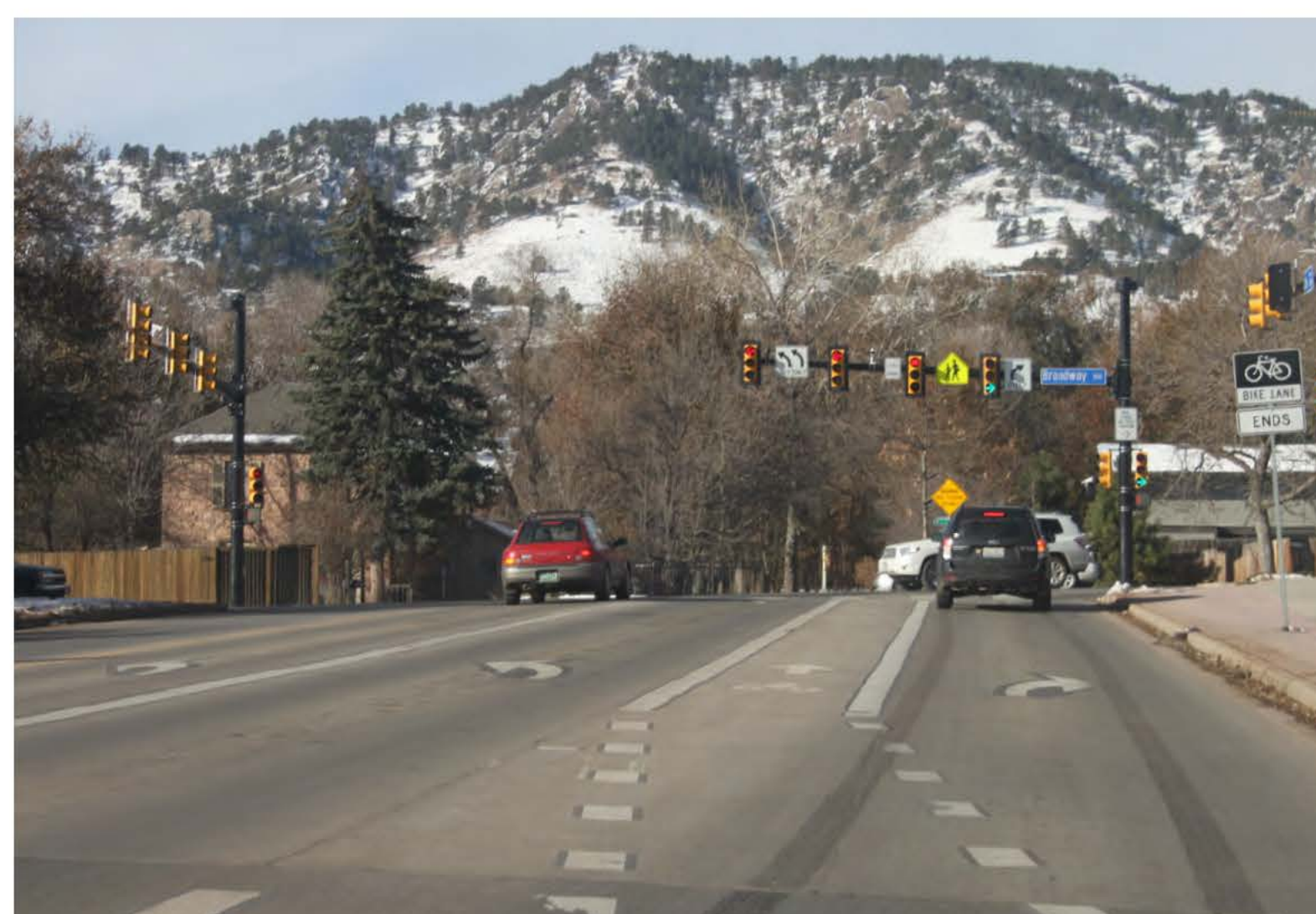
RIGHTSIZING CONDITIONS



EXISTING CONDITIONS



Iris at 19th looking west



Iris at Broadway looking west



Iris at Broadway looking east

More info: www.bouldercolorado.gov/goboulder





IRIS ST. OPTIONS

Iris 1

Two westbound
left turn lanes



Iris 2

One westbound
left turn lanes at Broadway



Existing Conditions	<ul style="list-style-type: none"> • Four lane arterial roadway with sub-standard vehicle and bike lanes in each direction. 	
Proposed Conditions	<ul style="list-style-type: none"> • Two lane arterial roadway with continuous center two-way left turn lane and protected bike lanes in each direction, and one of the two intersection options for Broadway below. 	
Options	Considerations	What do you think?
Iris 1 Two westbound left turn lanes	<ul style="list-style-type: none"> • Maintains vehicular capacity at Broadway for high-volume left-turn and mitigates most the potential corridor travel time increase with right sizing • Significantly reduces potential WB queues when compared to full right size option. 	
Iris 2 One westbound left turn lanes at Broadway	<ul style="list-style-type: none"> • Provides buffered bikeway the entire length of the corridor in both directions. • Allows double buffered bikeway at Broadway WB. • Increases delay and queue of WB traffic at Broadway. The queue blocks vehicles from reaching appropriate turn lane and resulting compounding queues were modeled to extend east to 19th Street • Increases average WB travel time significantly (nearly double) in the PM peak hour. 	

More info: www.bouldercolorado.gov/goboulder





55TH STREET

RIGHTSIZING CONDITIONS



EXISTING CONDITIONS



55th at Flatiron looking south



55th at Pearl looking north



55th at Arapahoe looking south

More info: www.bouldercolorado.gov/goboulder



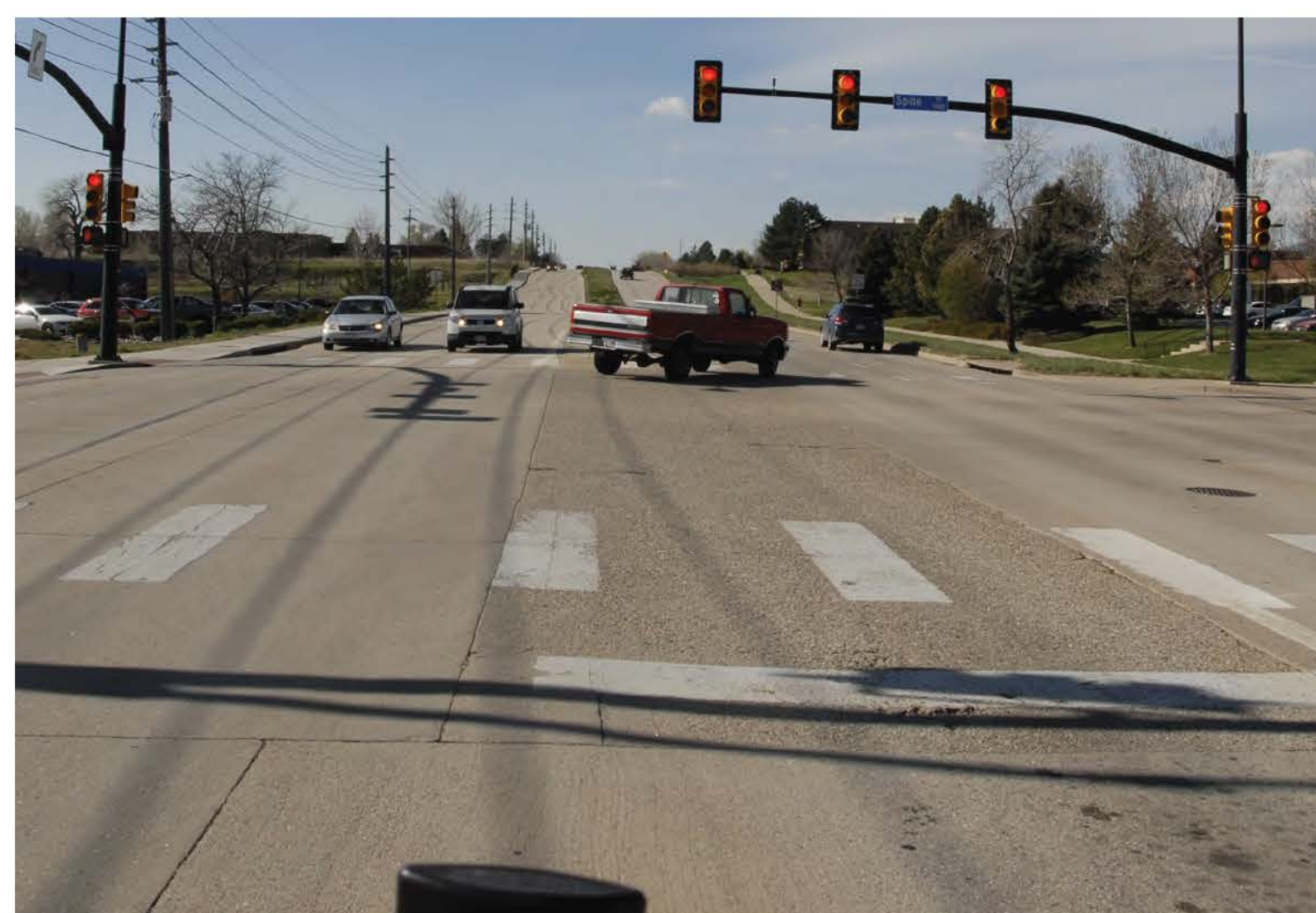


63RD STREET

RIGHTSIZING CONDITIONS



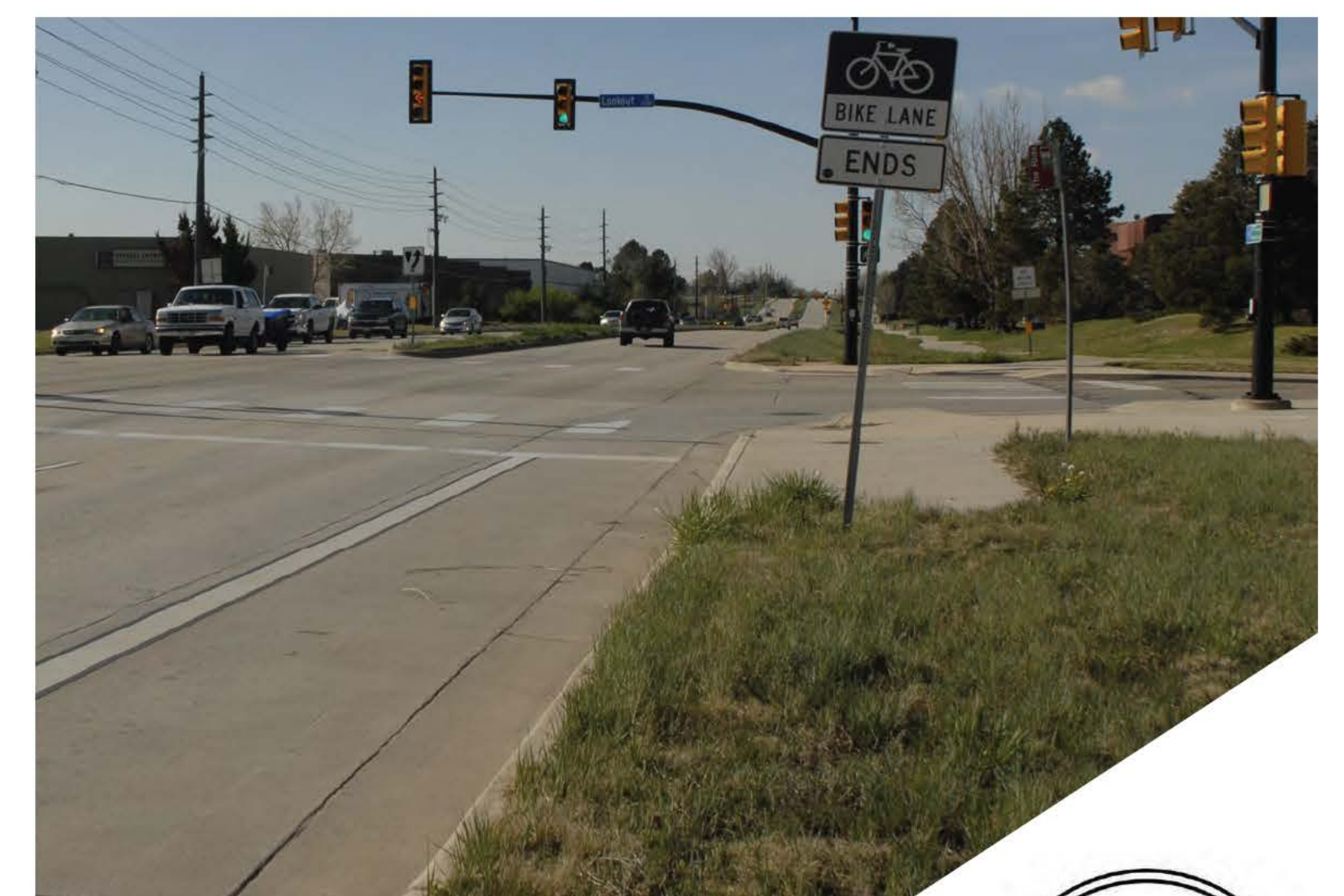
EXISTING CONDITIONS



63rd at Spine looking south

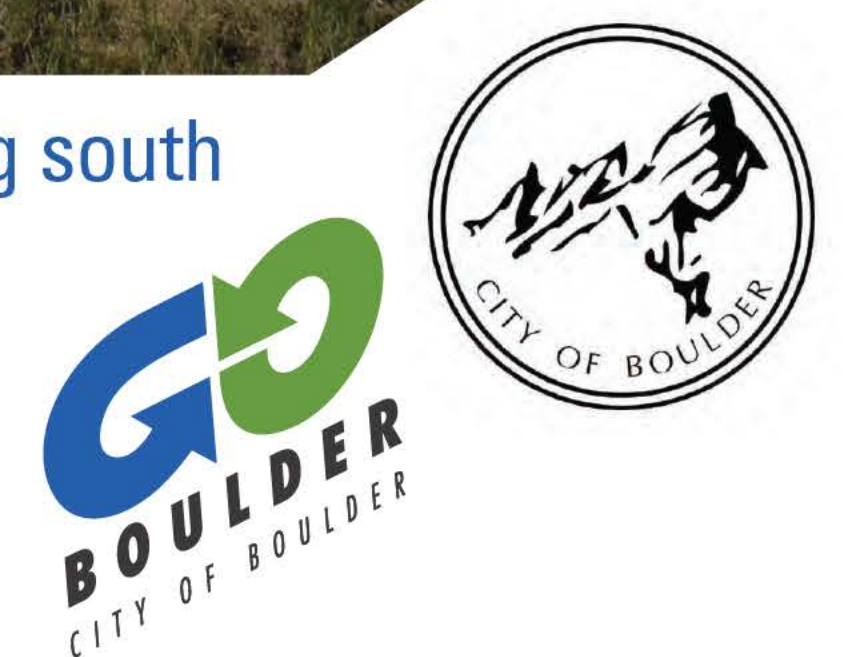


63rd looking south towards Spine



63rd at Lookout looking south

More info: www.bouldercolorado.gov/goboulder





PROJECT TIMELINE

Community Engagement

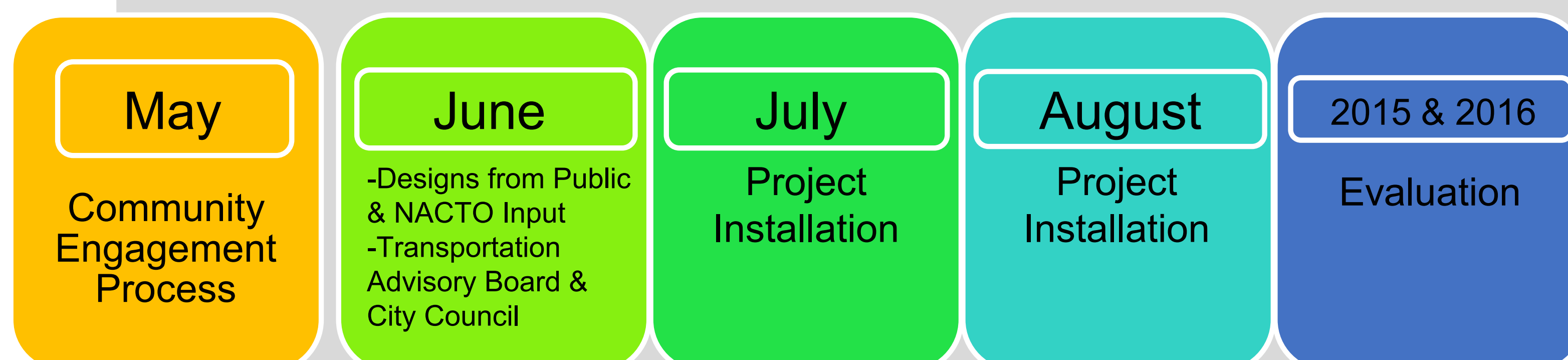
Public input along with the technical analysis and financial considerations will guide the development of a staff recommendation on the proposed Phase II candidate corridors and design options.

May 2015				
Monday	Tuesday	Wednesday	Thursday	Friday
4	5	6	7	8
East Stakeholder Meeting 4:00 – 6:00 p.m. Valmont Presbyterian Church	Pop Up Events Iris Foothills Elementary 7:45 – 8:15 a.m. City Council Meeting 6:00 p.m.	West Stakeholder Meeting 4:00 – 6:00 p.m. Unity Spiritual Center of Boulder	Walk/Bike Audit Iris & Folsom 4:00 – 6:00 p.m. Pop Up Events McGuckins 11:00 a.m. – 2:00 p.m.	
11	12	13	14	15
TAB Meeting City Council Chambers 6:00 p.m.	Pop Up Events 55th Laughing Goat Upslope 4:00 – 6:00 p.m.	Presentation to Better Boulder 4:00 p.m.		
18	19	20	21	22
		Living Lab Open House 4:00 – 6:00 p.m. BMOCA	Walk/Bike Audit 55th 4:00 – 6:00 p.m.	
25	26	27	28	29
Memorial Day	Pop Up Events 63rd Page Two Avery		Walk/Bike Audit 63rd 4:00 – 6:00 p.m.	

Beyond May: June 8th - **TAB Meeting** 6:00pm
June 16th - **City Council Meeting** 6:00pm

Phase II — Summer 2015–2016

NEXT STEPS



More info: www.bouldercolorado.gov/goboulder





STAY UP TO DATE

Stay updated on the Living Lab in multiple ways:

Visit goboulder.net to...

- Sign up for the Living Lab stakeholder e-newsletter
- Read more on the background of the Living Lab, the Transportation Master Plan, and how to plan your trip around Boulder

Visit InquireBoulder.net

- Virtual city information desk

Visit InspireBoulder.com

- Add your feedback to the Living Laboratory Program: Transportation Innovations

Visit boulder.commonplace.is

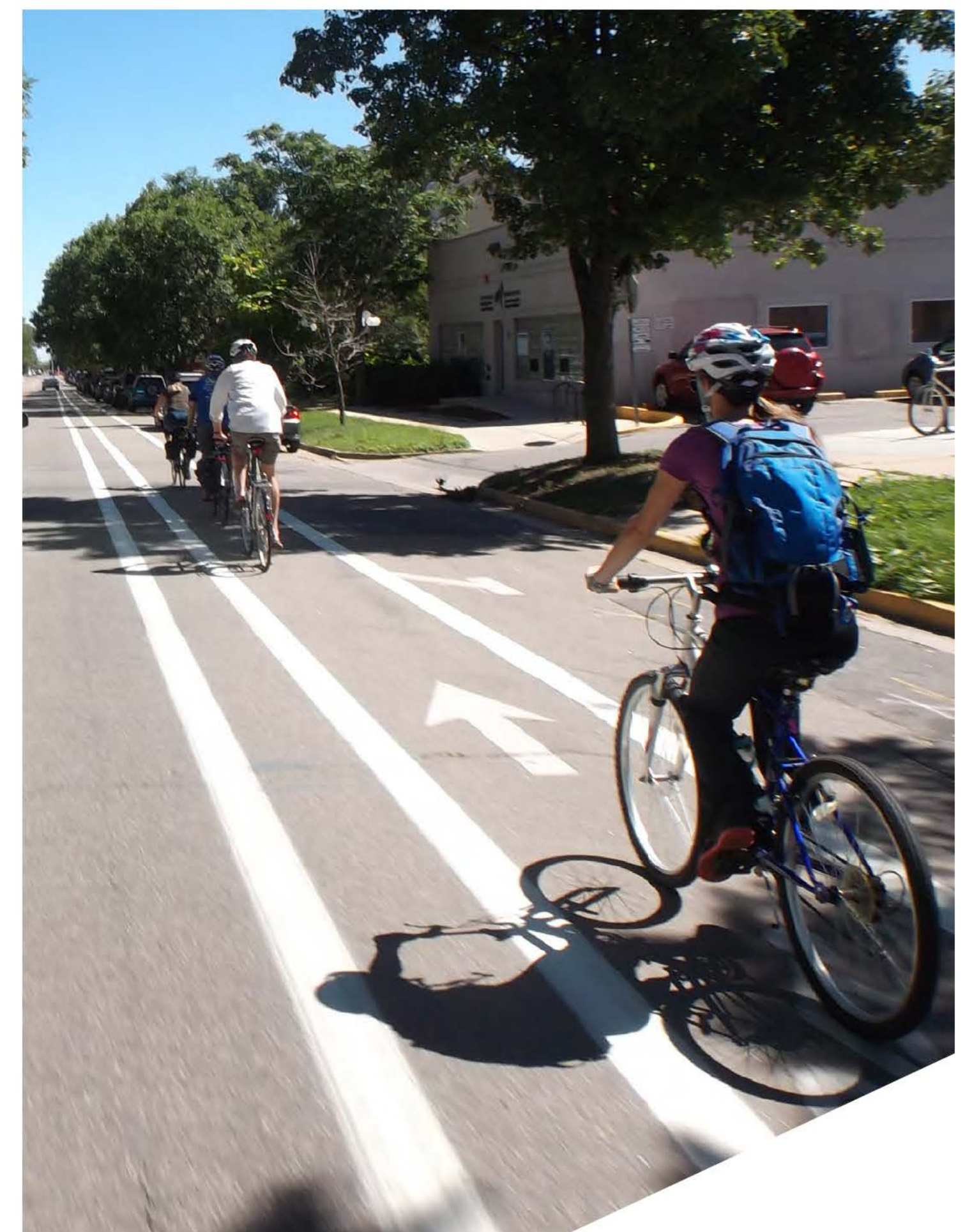
- Share your experience on-the-go using this geographically-based tool and Twitter to post a comment on the Commonplace map

Participate in bike and walk audits

Email or call us

- Dave "DK" Kemp
Senior Transportation Planner
GO Boulder/City of Boulder
dk@bouldercolorado.gov
303.441.1955
- Marni Ratzel
Senior Transportation Planner
GO Boulder/City of Boulder
RatzelM@bouldercolorado.gov
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